PROJECT facts

U.S. Department of Energy
National Energy Technology Laboratory

Sequestration

08/2002

Sorbent Development for Carbon Dioxide Separation and Removal — Pressure Swing Adsorption & Temperature Swing Adsorption

PRIMARY PARTNER

National Energy Technology Laboratory
Carnegie Mellon University
Süd Chemie

DOE FUNDING PROFILE

Prior FY's	$ 400,000
FY2002	$ 400,000
Future FY	TBA

TOTAL ESTIMATED COST

DOE	$ 800,000

CUSTOMER SERVICE

800-553-7681

WEBSITE

www.netl.doe.gov

Background

Selective separation of CO_2 can be achieved by the preferential adsorption of the gas on high-surface area solids. Conventional physical adsorption systems are operated in pressure swing adsorption (PSA) and temperature swing adsorption (TSA) modes. In PSA, the gas is absorbed at a higher pressure. Then pressure is reduced to desorb the gas. In TSA, the gas is absorbed at a lower temperature. Then, the temperature is raised to desorb the gas. PSA and TSA are some of the potential techniques that could be applicable for removal of CO_2 from high-pressure gas streams, such as those encountered in Integrated Gasification Combined Cycles (IGCC).

Primary Project Goal

The object of this project is to develop regenerable sorbents that have high selectivity, high regenerability, and high adsorption capacity for CO_2 — properties critical for the success of the PSA/TSA process.

Objectives

- Develop a new class of more efficient sorbents that are operational at moderate or high temperatures.
- Complete a system analysis with moderate/high temperature PSA/TSA processes for separation of CO_2, along with molecular simulations of CO_2/surface interactions.

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CONTACT POINTS

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Accomplishments

Several zeolites from Süd Chemie were tested and have shown promising results.

Multi-cycle reactor tests showed that the highest adsorption capacity was observed when the major cation of the zeolites was sodium. A new class of sorbents (not zeolites) was prepared at NETL with excellent regenerability and high CO_2 adsorption capacity. Carnegie Mellon University (CMU) has initiated molecular simulations of CO_2 adsorption on zeolites in order to understand the selective adsorption process in zeolites. CMU is also conducting process simulation work on CO_2 Pressure Swing Adsorption to determine the optimal process. This process simulator, once validated, will be useful in developing sorption process performance estimates.

NETL developed sorbent

Benefits

The project shows considerable promise for developing a more energy efficient PSA process. This could also be applicable for removal of CO_2 from high-pressure gas streams, such as those encountered in Integrated Gasification Combined Cycle (IGCC) systems.